

July 2014 - A Quarterly Publication

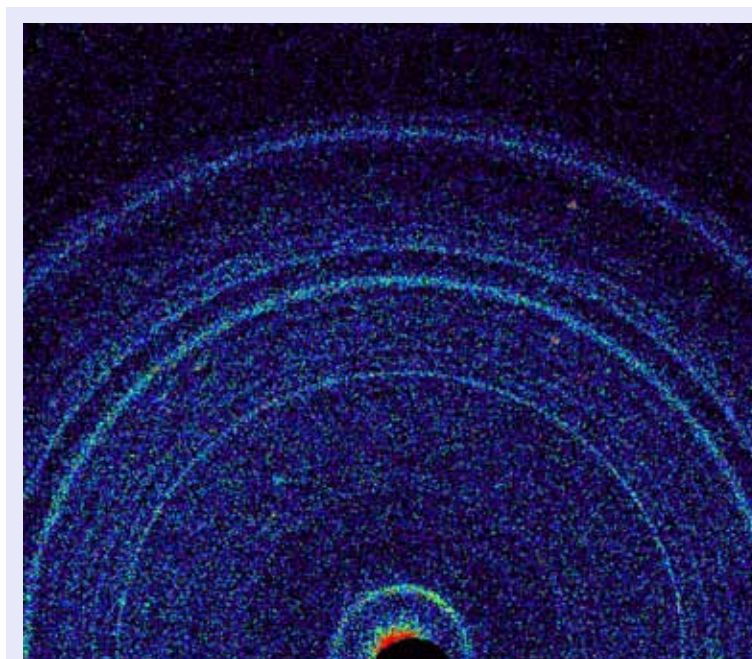
## Ames CheMin instrument wins NASA invention award

BY RACHEL HOOVER

NASA Ames has won the 2013 NASA Government Invention of the Year award for the Chemistry and Mineralogy (CheMin) X-ray diffraction instrument aboard the Mars Science Laboratory rover Curiosity. CheMin's identification of minerals in rocks and soil is crucial to the mission's goal of assessing past environmental conditions and habitable environments.

The CheMin instrument was invented by David Blake of Ames; Phillipe Sarrazin of the SETI Institute and Inxitu Inc. in Mountain View, as well as Olympus Corp. in Scotts Valley; Friedemann Freund of the SETI Institute; and Charles Bryson of Aparati Inc. in Hollister.

"The outstanding work of the CheMin team has made a significant and lasting contribution to Ames' technology portfolio and offers game-changing capability to NASA missions and other government programs," said S. Pete Worden, Ames Center Director. "As a center, we have enjoyed great success in previous NASA Invention



This shows the X-ray diffraction patterns made from data obtained by Curiosity's Chemistry and Mineralogy instrument (CheMin) of a sample collected from the Martian surface by NASA's Curiosity rover. Image Credit: NASA/JPL-Caltech/Ames

of the Year competitions; this award adds to our proud legacy."

More than 20 years ago, Blake

began working on a compact X-ray diffraction instrument for use in planetary

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## California legislature awards Ames 75th anniversary proclamation

Ames received the 75th Anniversary Proclamation from the California legislature in March 2014 during the

American Institute for Aeronautics and Astronautics (AIAA) sponsored third annual California Aerospace Week

in Sacramento.

The proclamation reads:

Whereas, The year 2014 marks the seventy-fifth anniversary of the Ames Research Center of the National Aeronautics and Space Administration (NASA Ames), and since its establishment on December 20, 1939, in the California towns of Sunnyvale and Mountain View, the scientists, engineers, and staff of NASA Ames have

a long legacy of significant contributions to the welfare and economic well-being of the people of California; and

Whereas, The planetary and earth scientists of NASA Ames have inspired in all Californians a sense of awe at the vastness, beauty, and complexity of the universe through robotic missions to explore our solar system and to probe the atmospheres of other planets and enhanced our understanding of our own planet through pioneering observational instrumenta-

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NASA photo by Dominic Hart

Assemblyman Rich Gordon (left) presents Ames Deputy Center Director Lewis Braxton III with the 75th Anniversary Proclamation of Ames In March 2014.



# NASA turns World Cup into lesson in aerodynamics

BY JONAS DINO

Excitement had built for fans across the globe with the recent Fédération Internationale de Football Association (FIFA) 2014 World Cup tournament. These fans included NASA engineers, who used the lead-up to the tournament to test the aerodynamics of this year's new ball design, developed by Adidas and dubbed the Brazuca ball.

Although NASA is not in the business of designing or testing balls, the tournament provided an opportunity to explain the concepts of aerodynamics to students and individuals less familiar with the fundamentals of aerodynamics.

"Sports provide a great opportunity to introduce the next generation of researchers to our field of aerodynamics by showing them something they can relate to," said Rabi Mehta, chief of the Experimental Aero-Physics Branch at NASA Ames.

Aerodynamics is the study of how air and liquids, referred to collectively as "fluids" in aerodynamics research, flow around objects. Engineers at Ames, a world leader in fundamental aerodynamics research, possess an in-depth understanding of how fluids flow around simple three-dimensional shapes such as cylinders and spheres. With this knowledge, engineers can predict how even the minor alterations in these basic shapes change flow patterns.

The previous World Cup ball, the Jabulani, was described as sometimes demonstrating "supernatural" movements. It was beloved by strikers but hated by goalkeepers because, when kicked with little or no spin, the ball "knuckled," giving strikers a greater chance of scoring. Knuckling occurs when, at zero or near-zero spin, the seams of the ball channel airflow in an unusual and erratic manner making its trajectory unpredictable.

Taking full advantage of a ball's flight characteristics to gain an advantage is nothing new in sports. In baseball, the only difference between a curveball, a fastball, a slider or a knuckle ball is how a pitcher manipulates the spin of the baseball with



NASA photo by Dominic Hart

Soccer ball airflow being examined by Rabi Mehta, NASA researcher at the Fluid Mechanics Laboratory, Ames Research Center.

respect to its stitches. On a football, there are no external stitches piecing the outer covering of the ball together but it does have seams, many of them.

To address the unpredictability of the Jabulani ball, Adidas worked with hundreds of players to develop the Brazuca football. A traditional football has 32 panels, the Jabulani has eight panels and the Brazuca has only six.

Despite having fewer panels, the finger-like panels on the Brazuca increase the seam length, compared to previous World Cup balls. The seams are also deeper than those of the Jabulani and the panels are covered with tiny bumps; all of these factors influence the ball's aerodynamics.

What seems like common sense about air moving around a simple sphere does not, in fact, bear true. The airflow around a sphere is not smooth; a great amount of drag is created behind the object. An example of this can be seen on a golf course, where a smooth golf ball travels much shorter distances than a regular, dimpled golf ball. The dimples on the ball's surface agitate the air creating a smaller low-pressure wake behind the ball and decreasing drag, therefore increasing its distance.

"There is a thin layer of air that

forms near the ball's surface called the boundary layer and it is the state and behavior of that layer that is critical to the performance of the ball," said Mehta. "The materials used, the ball's surface roughness and its distribution determines its aerodynamics."

The overall increased roughness of the Brazuca football will help to decrease the ball's knuckling tendencies at kicking speeds typically encountered in the World Cup.

In the two-foot-by-two-foot wind tunnel in the Fluid Mechanics Laboratory at Ames, Mehta demonstrates the airflow around the Brazuca football releasing controlled smoke flow over the surface of the ball highlighted with laser light to increase flow visibility. At different speeds, there are noticeable differences in airflow around the ball.

"What we are looking for in the smoke patterns is at what speed the smoke patterns suddenly change," remarked Mehta. This is when the knuckling effect is greatest."

Tests in the wind tunnel and a 17-inch water channel, which uses florescent dye dispensed into the fluid flow under black lights, shows that the speed of greatest knuckling for a traditional ball is around 30 miles

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## Ames proudly marches in San Francisco (LGBT) Pride Parade

This year, Ames officially participated in the San Francisco Lesbian Gay Bisexual Transgender (LGBT) Pride Parade on Sunday, June 29, 2014. The parade began at 10:30 a.m. and travelled down Market Street for about 1.5 miles. The Ames LGBT Advisory Group organized the contin-

gent that marched in the parade. All Ames staff members were invited to march.

In the past, the SF Pride Parade has drawn up to one million viewers along the parade route. The parade also is televised throughout the Bay Area. This

made the Pride Parade an excellent opportunity for individual staff members, organizations and missions to raise awareness of Ames and the work we do.

*(Below) Ames Center Director S. Pete Worden (left, sitting on top of passenger seat) waves at the crowd as he travels down Market Street in the San Francisco Pride Parade June 29, 2014.*



*(Above) Ames Center Director S. Pete Worden (right) with Ames Director of Strategic Communications and Education Donald James, walking in the Pride Parade.*

*(Right) Ames employees, along with friends and family members, walking down Market Street, San Francisco, during the Pride Parade in June.*



photos by James Schwab

## Astronomers confounded by massive rocky world

BY MICHELE JOHNSON

Astronomers have discovered a rocky planet that weighs 17 times as much as Earth and is more than twice as large in size. This discov-

Kepler-10c, as it had been named, had a previously measured size of 2.3 times larger than Earth but its mass was not known until

looning the planet to a gas giant the size of Neptune or even Jupiter. However, this planet is thought to be solid, composed primarily of rock.

"Just when you think you've got it all figured out, nature gives you a huge surprise – in this case, literally," said Natalie Batalha, Kepler mission scientist at NASA Ames. "Isn't science marvelous?"

Kepler-10c orbits a sun-like star every 45 days, making it too hot to sustain life as we know it. It is located about 560 light-years from Earth in the constellation Draco. The system also hosts Kepler-10b, the first rocky planet discovered in the Kepler data.

The finding was recently presented at a meeting of the American Astronomical Society in Boston. Read more about the discovery in the Harvard-Smithsonian Center for Astrophysics press release.

NASA's Ames Research Center manages Kepler's ground system development, mission operations and science data analysis. NASA's Jet Propulsion Laboratory, Pasadena, California, managed the Kepler mission's development.

Ball Aerospace and Technologies Corp. in Boulder, Colorado, developed the Kepler flight system and supports mission operations with the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

The Space Telescope Science Institute in Baltimore archives, hosts and distributes Kepler science data. Kepler is NASA's 10th Discovery Mission and is funded by NASA's Science Mission Directorate at the agency's headquarters in Washington.

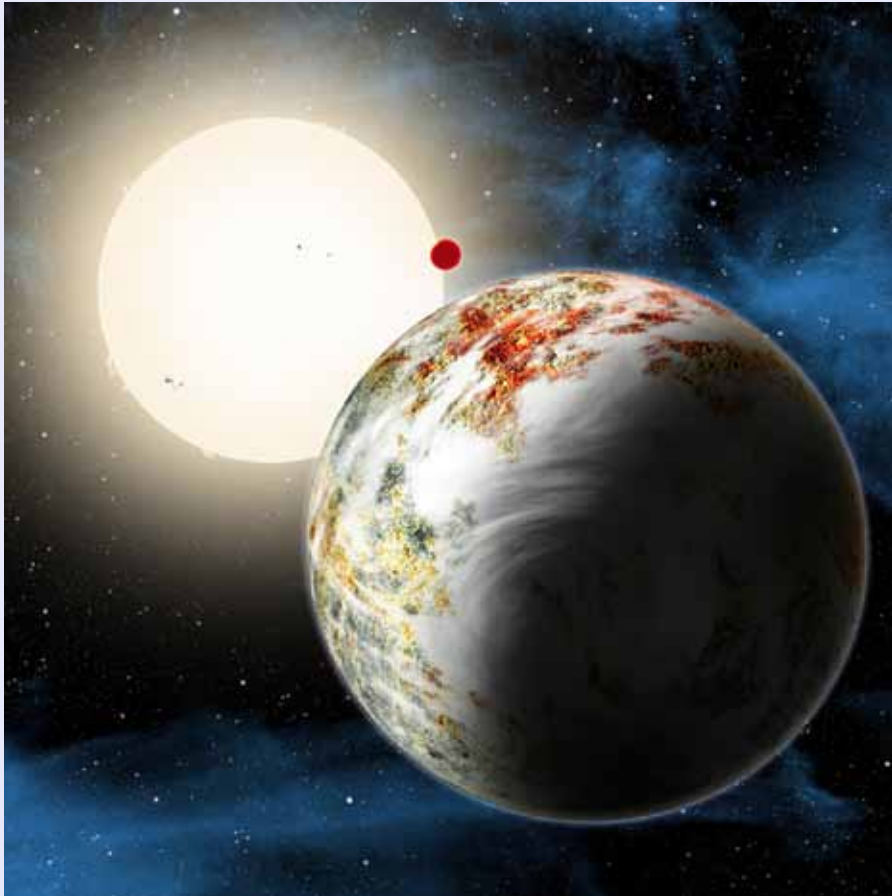


Image Credit: Harvard-Smithsonian Center for Astrophysics/David Aguilar

*An artist concept shows the Kepler-10 system, home to two rocky planets. In the foreground is Kepler-10c, a planet that weighs 17 times as much as Earth and is more than twice as large in size. This discovery has planet formation theorists challenged to explain how such a world could have formed.*

ery has planet formation theorists challenged to explain how such a world could have formed.

"We were very surprised when we realized what we had found," says astronomer Xavier Dumusque of the Harvard-Smithsonian Center for Astrophysics (CfA), who led the analysis using data originally collected by NASA's Kepler space telescope.

now. The team used the HARPS-North instrument on the Telescopio Nazionale Galileo in the Canary Islands to conduct follow-up observations to obtain a mass measurement of the rocky behemoth.

Worlds such as this were not thought possible to exist. The enormous gravitational force of such a massive body would accrete a gas envelope during formation, bal-



## Foreword to Atmosphere of Freedom: 75 Years at the NASA Ames Research Center (NASA SP-2014-4314)

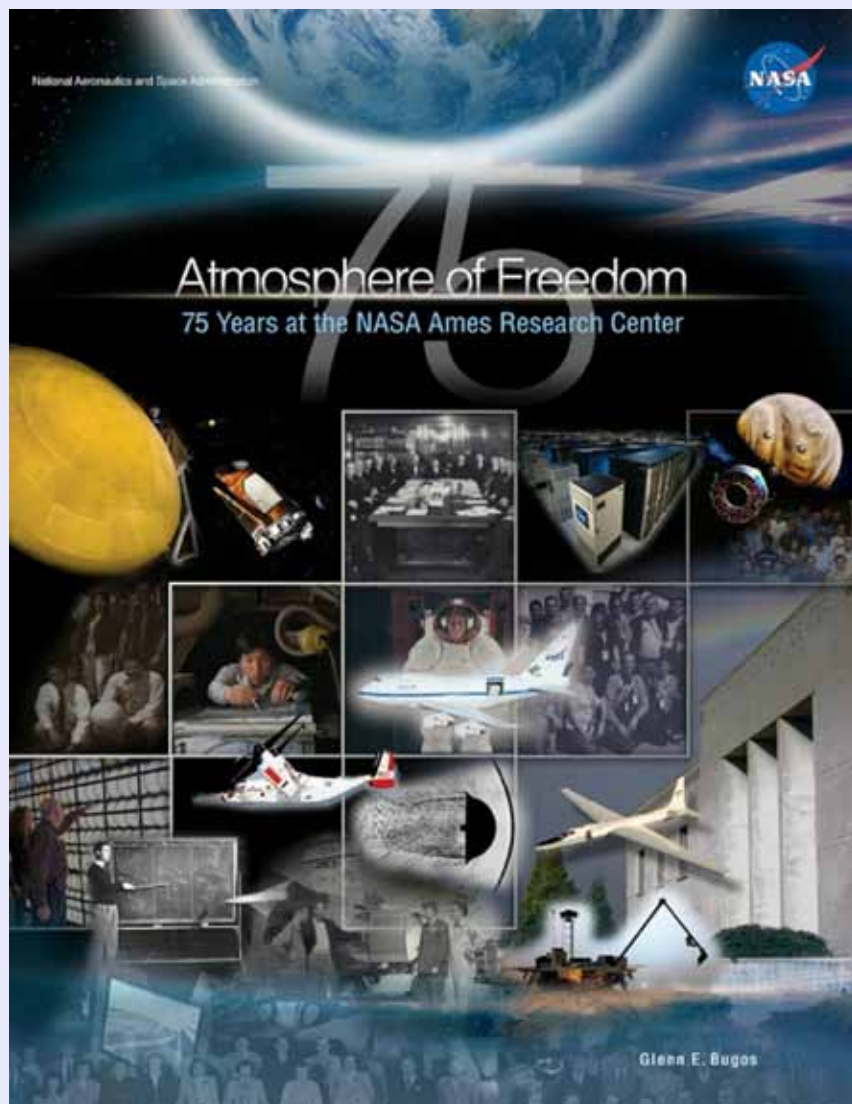
BY PETE WORDEN AND JACK BOYD

Ames is the coolest place to work in the federal government. That was true when one of us (Jack) joined the laboratory in 1947, true when the other (Pete) joined in 2006. And it is true today. Part of what makes it so cool is the history we inherited. Our two offices are steps apart, and during the course of any day we often discuss what parts of Ames' past are relevant to some urgent management decision.

And it's not just the two of us. People all around Ames often swap stories about how well Ames' heritage supports America's vision of the future of space exploration. Part of what makes Ames so cool is the constant dialogue between past and future, between capabilities and potential, between the science fiction of yore and the realities of what we do today, and between those giants of aerospace engineering who have walked our campus and those many young folk freshly hired who seek to learn from them. Ames has recently made a major effort to hire and give wings to the best and brightest of the next generation of space explorers. Part of what attracts them to this place is the way we have done what we do.

One of ten NASA field centers around the country, Ames is located at the heart of Silicon Valley. While Ames developed its own in-house expertise in computation and the life sciences, we have always partnered closely with the computing and biotechnology firms active in the Silicon Valley community that sprung up around our

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## Atmospheric science: NASA Ames' early contribution to our home planet (part two)

BY RUTH DASSO MARLAIRE

Between 1978 and 1984, James Pollack was the chief scientist of the Ames Climate Office. He also was the chief scientist of a program called Aerosol Climate Effects (ACE). The program was designed to study the climate effects of aerosols in Earth's atmosphere. As chance would have it, Ames research scientists were given unique circumstances to study two of the most catastrophic eruptions in modern time. On May 18, 1980, Mount St. Helens erupted in Washington, killing 65 people and causing mud flows to

the west, in Yakima, Washington and falling ash to the east, in Spokane, Washington.

Ames scientists and aircraft became part of an expedition that measured the properties of the gases and aerosols (particles) in the volcanic clouds produced by the eruptions. Ames employed the U-2, a surplus aircraft given to Ames by the U.S. Air Force, to fly to the stratospheric height needed to collect samples, the most complete set of observations ever recorded of volcanic aerosols in the

stratosphere, according to the Ames Astrogram.

Two years later, the El Chichon volcano erupted in northwestern Chiapas, Mexico, killing more than 2,000 people and destroying nine villages near the volcano. The eruption was unique because it released unusually large amounts of sulfur into the atmosphere. Three weeks after the eruption, the volcanic plume had encircled Earth.

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## Foreword to Atmosphere of Freedom: *75 Years at the NASA Ames Research Center (NASA SP-2014-4314)*

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center. We do the non-traditional, and that is where creativity springs forth. The organizational culture of NASA Ames reflects that of Silicon Valley: collaboration with many partners to leverage proven strengths, the wisdom to nurture new disciplines, a willingness to work cheap and fast, a devilish desire to hack and test often, a need to match demonstration with theory, a longer view into the future of space exploration and, most importantly, the firm belief that we indeed can change the world.

During its earliest days, Ames researchers broke new ground in all flight regimes (the subsonic, transonic, supersonic, and hypersonic) by building increasingly sophisticated wind tunnels, arc jets, research aircraft and methods of theoretical aerodynamics. Extending its expertise into human factors and pilot workload research, Ames became NASA's lead center in basic life sciences research, which included radiation biology, adaptability to microgravity, and exobiology.

Some Ames aerodynamicists explored the complex airflows around rotorcraft and devised the first tilt-rotor aircraft, while others modeled airflows using new supercomputers and internetworking to create the field of computational fluid dynamics. Building upon its expertise in computational chemistry and materials science, Ames once pioneered the field of nanotechnology and likewise is now a leading force in the new field of synthetic biology.

Ames research in air traffic management helped make air travel safer and more energy efficient. Ames engineers and planetary scientists managed a series of airborne science aircraft, of planetary atmosphere probes and robotic explorers like the Pioneer spacecraft and Lunar Prospector. Ames pioneered the "virtual institute" to develop the disciplines of astrobiology and lunar science. More recently, Ames has been innovating in the engineering of small and modular spacecraft.

Some of Ames' greatest contributions to America's aeronautics and

*Ames has emerged as NASA's leading center in supercomputing and information technology, astrobiology and the space life sciences, earth and planetary science, materials science and thermal protection systems, and small spacecraft engineering.*

space program include the swept-back wing concept that is used on all high-speed aircraft today; the blunt body concept, which is used on every spacecraft to prevent burning upon planetary entry; the management of the Pioneer spacecraft, which included the first human-made object to leave our planetary system; the disciplines of computational fluid dynamics and astrobiology; the Lunar Prospector mission, which discovered water at the poles of the moon as well as the LCROSS mission which confirmed it; and the Kepler mission to find potentially habitable exoplanets, which was one of the first astrobiology-driven missions.

Ames has emerged as NASA's leading center in supercomputing and information technology, astrobiology and the space life sciences, earth and planetary science, materials science and thermal protection systems,

and small spacecraft engineering. We've drawn new types of researchers into space exploration by creating the NASA Research Park, a premier space for collaborative corporate research and innovative educational facilities to train the future aerospace workforce. With more than \$3 billion in capital equipment in 2013, a research staff 2,400 people strong, and an annual budget of more than \$900 million, Ames plays a critical role in virtually all NASA missions in support of America's space and aeronautics programs.

We dedicate this book to the many women and men who have dedicated their careers to the long success of NASA's Ames Research Center and who make our center so cool.

### Atmospheric science: NASA Ames' early contribution

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To study this catastrophic eruption, Ames again sent its research team, but this time the NASA Convair 990, a modified jet transport that could fly relatively long distances and carry a heavy payload. The aircraft flew below the plume to collect samples and make observations at different latitudes to get a global picture of cloud coverage and composition.

Over the years, the demand continued to grow for flight expeditions and airborne laboratories. After a long history of field campaigns, Ames developed the Earth Science Project Office in 1987, which continues to

provide project management to the agency's airborne research expeditions.

To this day, Ames continues to be a leading NASA center in atmospheric science research and airborne research campaigns.

For further information about the Ames Earth Science Project Office, see: <https://www.espo.nasa.gov/>

*This is the second part of a two-part article. To read part one, see the April 2014 edition of the Astrogram, which is available online as a pdf at: <http://www.nasa.gov/centers/ames/news/astrogram/>*



## Commander in Chief visits Bay Area, lands at Moffett



Official White House Photo by Pete Souza



NASA photo by Eric James

President Barack Obama arrived onboard Air Force One, above left, at Moffett Federal Airfield May 8 and departed from the airfield the following day. This is the fourth time in the past three years Ames has hosted members of the White House staff supporting Obama's visit to Silicon Valley. Obama is seen here, above right, greeting Ames Center Director S. Pete Worden and, left, he greets Ames Deputy Center Director Lewis Braxton's wife and Ames employee Veronica Braxton and other invited guests, on his way to his Bay Area events.

## Bolden discusses climate assessment

NASA Administrator Charles Bolden discusses Third National Climate Assessment in front of the hyperwall during his recent visit and media event at Ames in May 2014.



NASA photo Eric James

## Cheesy Poofs win 2014 FRC world championship



Team 254, the "Cheesy Poofs," consisting of members from NASA Ames/Bellarmine College Preparatory, San Jose, California, pose right after their alliance won the 2014 FIRST Robotics Competition (FRC) World Championship April 26, in St. Louis, Mo. The team went undefeated in the qualification rounds of the Curie Division and paired with teams 469, 2848 and 74 for elimination matches. After a hard fight through the elimination rounds, the team was crowned the champions of the 2014 FRC season after winning the Einstein finals.

## McKay discusses principle of the tricorder application to NASA



NASA photo by Eric James

In May, Christopher McKay, a research scientist in the Space Science Division, presented the ninth lecture in the series of "Ames Distinguished Employee Lectures." McKay is seen here, left, presenting his paper "The Principle of the tricorder and its application to NASA missions."

The tricorder is a multi-use instrument postulated in Star Trek. Of particular interest, is its capability to detect life remotely. McKay discussed the physical principle, as we currently understand it, and reviewed its application to future NASA planetary missions in the solar system.

McKay's current research focuses on the search for life on other worlds. He also is actively

involved in planning for future Mars missions including human exploration. McKay has been involved in research in Mars-like environments on Earth, traveling to the Antarctic dry valleys, Siberia, the Canadian Arctic, and the Atacama, Namib and Sahara deserts to study life in these Mars-like environments. He was a co-investigator on the Huygens probe to Saturn's moon Titan in 2005, the Mars Phoenix lander mission in 2008, and the current Mars Curiosity rover mission (2012).



## Kids learn about Ames during “Take Your Kids to Work Day”

NASA Ames employees and their families were invited to attend on April 24 “Take Your Child to Work Day.” Engineers, scientists and support teams at the center were encouraged to learn about the agency’s space programs. Thanks to the Ames Education and Public Outreach Office, children were able to visit NASA facilities, participate in education activities and shadow their parents during the workday. Exhibits at Shenandoah Plaza showcased NASA’s accomplishments and goals, from the benefits of space exploration here on Earth, to the technologies NASA develops to explore our solar system and beyond. The event demonstrated the value and rewards of studying science, engineering, math and technology.

NASA photo by Dominic Hart



NASA photo by Dominic Hart



NASA photo by Dominic Hart



NASA photo by Dominic Hart



NASA photo by Eric James



NASA photo by Eric James



## Ames CheMin instrument wins NASA invention award

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missions. CheMin and a number of commercial portable instruments that use its technology on Earth are the result of Blake's and his colleagues' work. In addition to remote field geology, these instruments also have innovative spinoff uses, such as the identification of counterfeit pharmaceuticals, the curation and preservation of art and antiquities, and homeland security.

"Our team is elated with the results from our instrument and excited about future CheMin analyses in the months and miles ahead," said Blake. "We are also very pleased that our analyses came back from Mars in the centennial year of the discovery of X-ray diffraction by Max von Laue in 1912."

CheMin uses X-ray diffraction, the "gold standard" for identifying minerals on Earth. X-ray diffraction works by directing an X-ray beam at a sample and recording how the X-rays are scattered by the sample's atoms. All minerals are crystalline, and in crystalline materials, atoms are arranged in an orderly, periodic structure, causing the X-rays to be scattered at predictable angles. From those angles, researchers can deduce the spacing between planes of atoms in the crystal, and from that, the identity of the mineral. The temperature, pressure, and chemistry of an environment -- including the presence of water -- determine what minerals form and how they are altered. Each mineral records the conditions under which it formed.

This shows the X-ray diffraction patterns made from data obtained by Curiosity's Chemistry and Mineralogy instrument (CheMin) of a sample collected from the Martian surface by NASA's Curiosity rover.

"CheMin represents the first use of X-ray diffraction for a Mars mission and it was critical in the identification of the first habitable environment on another planet," said Blake. "CheMin also provides a more definitive method to identify minerals than any instrument on previous missions."

Laboratory X-ray diffraction instruments are the size of large refrigerators and consume thousands of watts of power; CheMin is the size of a breadbox and operates on 40 watts of power. CheMin generates X-rays by aiming high-energy electrons at a target of cobalt, then aligning the cobalt X-rays into a narrow beam. The detector is a charge-coupled device (CCD) like the ones in electronic cameras, but sensitive to X-ray wavelengths and

the instrument. The other 27 are reusable holders for Martian samples. Samples of gritty powder delivered from Curiosity's sample acquisition and processing system to CheMin's inlet funnel each contain about as much material as in a baby aspirin.

"As a result of CheMin technology, discussions of the analyzed rocks and soil on Mars now revolve around the interpretation of the environment of formation of the minerals, rather than

a discussion of what the mineralogy might be," said Blake.

NASA's Jet Propulsion Laboratory in Pasadena, California manages NASA's Mars Science Laboratory Project for NASA's Science Mission Directorate at the agency's headquarters in Washington, and built the project's Curiosity rover.

Each NASA field center submits nominations for the awards, which are evaluated by NASA's Inventions and Contributions Board. The board determines which nominations qualify for each category, ranks the nominees and makes recommendations to the NASA Office of the General Counsel for review and approval.

Ames previously earned the NASA Government Invention of the Year award in the following years:

2007, for low-density, lightweight heat shield materials

2008, for a high-speed 3-D laser scanner with real time processing

2010, for software that creates simulations for managing air traffic scenarios

2011, for a low-cost, lightweight, two-piece, thermal protection system for use on space vehicles during atmospheric re-entry at hypersonic speed

2012, for a tiny sensor that can detect chemicals in the air.

Ames also won NASA Commercial Invention of the Year in 2010 for the Powder Handling Device for Analytical Instruments, and has won or been a co-winner of the NASA Software of the Year award 10 times since it was initiated in 1994.



*CheMin Principal Investigator David Blake collects data from a CheMin cousin called Terra. Image Credit: NASA*

cooled to minus 76 degrees Fahrenheit.

CheMin includes a number of novel methods and mechanisms, including the first use of a CCD to record the positions and energies of diffracted and fluoresced X-ray photons, a compact space-qualified X-ray source, and a vibrating sample holder which allows powder X-ray diffraction patterns to be collected without complex and precise movements of source, sample and detector components. The Powder Movement System for Analytical Instruments, which is now a part of the CheMin instrument, won NASA's Commercial Invention of the Year in 2010.

A sample wheel mounted between the X-ray source and detector holds 32 disc-shaped sample cells, each about the diameter of a shirt button and the thickness of a business card, with transparent plastic walls. Rotating the wheel can position any cell into the X-ray beam. Five cells hold reference samples from Earth to help calibrate



## Congratulations to Ames Honor Awards recipients for 2014

NASA Ames employees who received 2014 Ames Honor Awards this year are:

### Administrative Professional

Zachary Burkland  
Stacy Giffin  
Leticha A. Hawkins  
Patricia B. Hudson

### Commercialization/Technology Transfer

David McNally

### Contractor Employee

Victoria A. Casillas,  
Al-Razaq Computing, Financial  
Support Services  
James T. Chartres, Millennium  
Engineering & Integration Co.  
William E. Endter, ASRC Research  
& Technology Solutions  
Gordon H. Hardy, SAIC  
Hai T. Huynh, SAIC  
Brian T. Johnson, Millennium  
Engineering & Integration Co.  
James R. Schaeffer, BAERI  
William M. Toscano, Deltha-Critique  
Joseph D. Twicken, SETI Institute

### Diversity and Opportunity

Jeanette Zamora-Ortega

### Education and Outreach

Jonas G. Dino  
Tori M. Hoehler

### Engineer

Nghia N. Mai  
Gloria K. Yamauchi

### Group/Team

ARC I3P Center Integration and  
ACES CMDDB Team  
Collaboration Team  
The Edison Demonstration of  
Smallsat Networks Team  
Lunar Atmosphere and Dust  
Environment Explorer Team  
NASA Ames Office of Education  
and Public Outreach  
Pavilion Lake Research Project  
(PLRP)  
SOFIA CECS Code R Engineering  
Team  
SOFIA Ground, Mission and Science  
Operations Team  
SOFIA Mirror Coating System  
Relocation Team  
SOFIA Pipeline Development Team  
SporeSat Project Team

### Mentor

Robert M. Haberle

### Project Management

Andres Martinez  
Deborah M. Westley

### Scientist or Researcher

Eric J. Jensen

### Special Appreciation

Randal T. Albertson, NASA  
Armstrong Flight Research Center  
Daniel P. Lockney, NASA  
Headquarters  
Kara M. Pohlkamp, NASA Johnson  
Space Center

### Student

Megan M. Carlson  
Gabriel L. Duenas

Matthew J. Heagy  
Amber J. Kuss  
Benjamin Waxman

### Supervisor/Manager

Thomas W. Berndt  
James A. Brass  
Kelly G. Kaplan  
Kelly J. Kasser  
Michael L. Marlaire

### Technical Support/Professional

Tony R. Caringello  
Philip M. Herlth  
Monica M. Mendoza  
Ralph Pelligra  
Trupti D. Sanghani

### Technician

Frank M. Larsen

## Ames 75th anniversary proclamation

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tion and data modeling to better our understanding of the environmental dynamics of Earth in order to develop new tools to fight fires, address the challenges of climate change, and make better decisions regarding our stewardship of the California ecosystem; and

Whereas, Through the Apollo, Shuttle, and International Space Station programs, the Center's spacecraft engineers have played a major role in the human exploration of space and conducted biological research

to enable long-term spaceflight and the eventual settlement of our solar system, and they have built, managed and operated some of the most spectacular spacecraft exploring our solar system, such as the Kepler exoplanet discovery mission and the LCROSS mission, which confirmed the presence of water on the Moon, and

Whereas, Technologists and educators at NASA Ames opened the new fields of supercomputing and used their work in science networking to lay the foundations of the commercial Internet, and they have established the earliest procedures for network security, served as a conduit for the

best work to move between government research and the firms of Silicon Valley, and pioneered new ways of partnering with schools, universities, institutes, and technology businesses throughout California and around the world, and

Whereas, Home to the largest wind tunnel in the world, a top-20 powerful supercomputer, and the greenest building in the Federal inventory, NASA Ames is a powerful and reliable source of employment and innovation

*...the scientists, engineers, and staff of NASA Ames have a long legacy of significant contributions to the welfare and economic well-being of the people of California ...*

in California, and through its highly skilled and motivated workforce, the facilities of the NASA Research Park that sit at the heart of Silicon Vally, and the technological spin-offs that energize industry through the region, the Center has an enormous direct and indirect impact on the economy of California; now, therefore, be it

Resolved by Assembly Members Richard S. Gordon and Al Muratsuchi and Senator Jerry Hill, That they recognize and commend the significant contributions the people of the NASA Ames Research Center have made to the history, economy, ecosystem, and the educational system of the State of California, its communities, and its citizens. Members Resolution No. 670

## Ames' unique airborne astronomy program, 1965-1995



NASA photo by Tom Trower

*Farewell to the KAO (Kuiper Airborne Observatory), Sept. 29, 1995. Staff from NASA Ames and many KAO investigators gathered to celebrate their experiences on this unique observatory. Decommissioned at the peak of her productive scientific career to aid the development of SOFIA (Stratospheric Observatory for Infrared Astronomy), she engendered an abiding nostalgia felt by all.*

*EDWIN F. ERICKSON,  
KAO FACILITY SCIENTIST*

In the early 1960s, a program of airborne science was begun at Ames under the leadership of Michel Bader. Aircraft were operated for scientists who provided specialized instruments which they used to measure atmospheric, geophysical, or astronomical phenomena not possible from the ground. Initially, the astronomy consisted of visible observations of comets and eclipses.

However, the mysterious clouds of Venus, thought to consist mostly of water vapor, required diagnosis with infrared spectral observations. Water vapor below aircraft altitudes blocks infrared radiation at most wavelengths. So, in 1966-67, Gerard P. Kuiper (University of Arizona) used NASA's Convair 990 to measure the near infrared spectrum of Venus, showing surprisingly that its clouds are devoid of water.

In the late 1960's Frank J. Low (Rice University) initiated far-infrared observations from an Ames Learjet, using his bolometer detectors and a clever 12-inch open-port telescope

developed by him and Carlton M. Gillespie. Low's measurements showed for example that Jupiter and Saturn emit more energy than they receive from the sun.

The results of Kuiper and Low stimulated astronomers and Ames Director Hans Mark and managers Bader and Robert M. Cameron to successfully promote a larger, dedicated observatory. Development was begun in 1969. For it, Mark convinced NASA to purchase a Lockheed C-141 Starlifter aircraft. He also established the Ames Astrophysics Branch headed by Fred C. Witteborn, to exploit research opportunities in the emerging discipline of infrared astronomy. Christened the Gerard P. Kuiper Airborne Observatory, the Ames-based KAO did astronomical observations for 21 years starting in 1974. Stalwart staff members over its lifetime were Gillespie and James O. McClenahan.

The KAO logged nearly 13,000 research flight-hours on some 1,460 flights. An average of 25 observational programs – all selected by peer review – were flown each year by a total of 126 research teams from mostly U.S.

institutions. Ames observers from the Space Science Division accounted for about 20 percent of the flight time awarded.

A few KAO science highlights: discovery of the rings of Uranus; early evidence for a massive black hole at the center of the Milky Way; discovery of powerful far infrared emission from normal galaxies; measurement of iron, cobalt, nickel, and argon manufactured in supernova SN1987A; and discovery of pre-biotic polycyclic aromatic hydrocarbon (PAH) molecules in the interstellar medium.

In addition to its scientific productivity, the KAO fostered the development of state-of-the-art astronomical instrumentation, provided training for young scientists, and enabled educational experiences for science teachers.

Participants in the KAO program fondly recall its challenging work, camaraderie, remarkable moments, and unique scientific achievements. Its legacy includes SOFIA, the Stratospheric Observatory for Infrared Astronomy.



## HACE hosts 12th annual Hispanic Heritage Golf Tournament



NASA photos by Eric James



In honor of Cinco de Mayo, the Ames Hispanic Advisory Committee for Employees (HACE) held its 12th Annual Hispanic Heritage Golf Tournament May 9 at the Moffett Field Golf Course.

## Ames hosts Sixth Annual Braxton Golf Tournament

In recognition of the Juneteenth celebration on June 13 the Ames African American Advisory Group invited employees to participate in the Sixth Annual Braxton Golf Tournament. The tournament was held at the Golf Club at Moffett Field. Prizes and lunch were provided. Photographed here are, from left to right, Ames Deputy Center Director Lewis Braxton, III; Jackie Winzer; Lewis Braxton Jr., (Lewis Braxton III's father); and Larry Johnson, friend of Lewis Braxton, Jr.



NASA photo by Dominic Hart



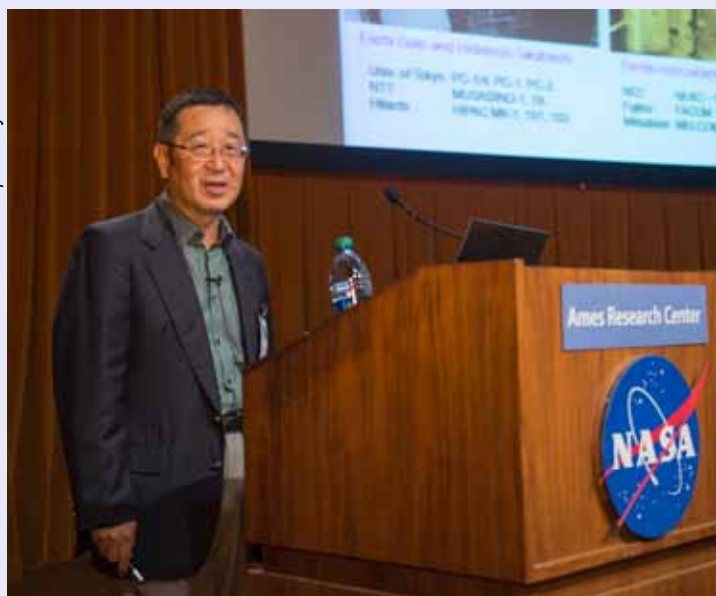
NASA photo by Dominic Hart

## Steel shares his inspiration for his exhibit

In June, celebrating the many contributions made by people with disabilities, the Employees with Disabilities Advisory Group (EDAG) proudly hosted Brian Charles Steel, a photographer from Atlanta, GA. Steel is known for his exhibit, "Impaired Perceptions," a series of black and white portraits that "compels us to suspend our judgments before getting to know someone. It also challenges us to accept our differences and the differences of others by reminding us that we are all different and in that way we are all the same." Steel gave a presentation about his life and how he was inspired to create this powerful exhibit.

## Yamamoto discusses topic of combinatorial optimization

NASA photo by Eric James



Professor Yoshihisa Yamamoto presented "Coherent Computing by OPO Phase Transition" in April as part of the Director's Colloquium Series. Yamamoto is a professor of applied physics and electrical engineering at Stanford University, where he has worked on dynamical condensation of exciton-polaritons, single photon generation and spin-based quantum information processing. NASA Ames is an agency leader in high-performance computing. The laboratory at the NASA Advanced Supercomputing (NAS) facility houses a 512-qubit D-Wave Two quantum computer which may someday dramatically improve the agency's ability to solve difficult optimization problems for missions in aeronautics, Earth and space sciences, and space exploration. In this presentation, combinatorial optimization problems were discussed in light of this pursuit.

## Administrative professionals learn about balance and well-being



Administrative Professionals' Week was April 21-25, and Ames participants attended a workshop with the theme of "Balance and Well-Being" on April 23. This theme highlighted and recognized the administrative support professionals at the center and their work in supporting the NASA mission. They learned de-stressor techniques and building an optimistic outlook for the future.



NASA photos by Dominic Hart



## Ames fire department and DART teams restore historic U-2 aircraft



Members of the Moffett Historical Society, Ames Fire Department, and Disaster Assistance and Response Team (DART) give a thumbs up after successfully reattaching the wings to the historic U-2 on display at the base of the iconic Hangar 1. Catch the October issue of the Astrogram for more pictures and the full story behind the project.

## Ames hosts Wounded Warrior Workforce Conference

Ames co-hosted the 5th Annual Wounded Warrior Workforce Conference in May. This public event included workshops on how to apply for federal jobs and resources for transitioning into the civilian workforce. A career fair followed for veterans and military spouses.

The Project HIRED Wounded Warrior Workforce Program supports disabled veterans by offering career exploration and development services, facilitating retraining, job searches and job retention, providing veterans with wrap-around support services within the organization and local community.

The program also supports employers of veterans with disabilities by providing HR support, management training, and consulting services.

To find out more about Project HIRED you can visit their website at [www.projecthired.org](http://www.projecthired.org).



Information booths at the recent 5th Annual Wounded Warrior Workforce Conference held at NASA Ames.



## Cayan discusses climate change vulnerability



*In May, Dan Cayan from Scripps Institution of Oceanography presented a seminar entitled, "Assessing California's Vulnerability to Climate Change." In this presentation, California's climate was reviewed from the perspective of its vulnerability to climate changes that may occur over the 21st century. A series of global, regional and local studies indicated how regional climate changes will likely exacerbate existing climate stresses and cause new ones. California and the western U.S. have already warmed over the last several decades and an ensemble of global and regional climate model simulations project considerably greater warming in the next several decades.*

NASA photo by Dominic Hart

## In Memoriam ...

### Former Ames flight ops specialist, Richard Gallant, passes on

Richard "Dick" Gallant died on May 24, 2014. Dick was born April 2, 1926, in Lawrence, Massachusetts. He attended Newman Preparatory School and studied horticulture at Stockbridge School of Agriculture in Amherst. He served in the Navy during World War II, stationed in Cuba and was honorably discharged in 1946.

Dick married his childhood sweetheart, Marcelle in 1951, and a few years later they moved to Santa Clara County. Shortly after their arrival, he met and became friends with George Cooper, chief pilot, Flight Operations Branch. George hired Dick as a flight equipment specialist.

Early in his NASA career, Dick teamed with other flight equipment specialists from Dryden and Langley in the modification of various pilot flight restraint and life support systems. Often these were unique systems that were modified for use on one-of-a-kind NASA research aircraft or flight simulators. Another key area of responsibility held by Dick was the management and operation of the Flight Operations

Radio Room and Flight Planning office.

Dick retired from NASA in December 1981 and accepted a position with Northrop. He resigned from Northrop in 1988. Dick developed many close friendships with his colleagues at Ames, which he maintained through retirement. He loved fishing, hiking and abalone diving and had a talent for watercolor painting and model wood boat building.

Dick is survived by his wife, Marcelle Gallant, three children, Greg, Diane and Jeannine, eight grandchildren and two great grandchildren. A memorial service will be held at noon on Saturday, July 26, 2014, at Corpus Christi Church in Piedmont, California. Family members invite all to attend the service and a party afterwards in his honor. In lieu of



Richard "Dick" Gallant

flowers, donations in his memory may be made to Alzheimer's Services of the East Bay, 2320 Channing Way, Berkeley, California 94704.



## Employees run, walk and stretch ...



NASA photos by Eric James



In May, Ames employees participated in the annual Ames Health and Fitness Days which included many events such as speakers presenting about topics related to healthier living, the return of the Fitness Challenge (second annual) and the Fun Run and Walk, followed by an outdoor yoga class.

## European prince tours Ames



NASA photo by Eric James

His Royal Highness Crown Prince Guillaume de Luxembourg visited NASA in May. The prince seen here (standing, far left) is at the Roverscape facility with Terry Fong (standing, right) Intelligent Robotics Group Lead and Vinh To (seated) operating the controls during a demonstration of surface telerobotics.

## Khan Academy inspires students



NASA photo by Eric James

"Khan Academy: Education Reimagined" was presented by Salman Khan (above) June 26, in the Syvertson Auditorium (N201) as part of the Director's Colloquium Summer Series. The Khan Academy is revolutionizing the way students learn with free online educational materials available to learners worldwide. NASA and Khan Academy recently debuted a series of tutorials to increase student interest in science, technology, engineering and mathematics, or STEM. Since the agency's inception in 1958, NASA has been using its discoveries to inspire students across the world. Founder of the Khan Academy Salman Khan spoke about how he has reimagined the way education is done.

## Ames employees sign the Orion “I’m on Board” banner

A representative from the Orion Program at NASA’s Johnson Space Center visited Ames in July with one of the program’s “I’m on Board” Orion banners for Ames staff to sign. This activity is meant to initiate public awareness, visibility and support of Orion’s first test flight, Exploration Flight Test (EFT)-1, in December 2014.

Individuals at Ames have contributed to the Orion Program through expertise in supercomputing, wind tunnel testing and thermophysics, among other topics.

During EFT-1, an uncrewed Orion will travel 3,600 miles into space, farther than any manned spacecraft in more than 40 years. Orion will travel at the speed necessary to test many of the systems critical to NASA’s ability to bring astronauts home safely from deep space missions, including an asteroid and eventually Mars.



Staff members at Ames sign the “I’m on Board” Orion banner.

photo by James Schwab

## Intern Poster Symposium set for Aug. 7

BY MEREDITH EDWARDS

On Thursday, Aug. 7, the Intern Poster Symposium will take place in Shenandoah Park in the afternoon around the lunch hour, hosted by the Office of Education and Public Outreach. There are hundreds of interns this summer who have been working alongside researchers, scientists and engineers, from a broad spectrum of divisions at NASA Ames who will be presenting their research to anyone who attends this event.

The entire Ames community is invited to attend this event to see the interns with their posters, as well as hear about the captivating research they have conducted alongside their NASA coworkers and mentors.

This year is one of our most diverse symposiums yet. We have a near-record breaking number of students this year, from all over the United States and several other countries. There are interns as young as high school level, all the way to PhD fellows participating in the symposium.

Hearing feedback about their posters and research is an invaluable asset to their future successes in and out of academia; especially from the intelligent minds we have here at

Ames. Please feel free to stop by for a few minutes or walk through the entire tent to see the exhibits, hear from speakers, and view the students’ posters. We’re going big this year!

## Lesson in aerodynamics

*continued from page 2*

per hour (mph). This is well below the typical kicking speed of a World Cup-caliber player, which is about 50 to 55 mph. Interestingly, the Jabulani, a much smoother ball, produced its greatest knuckling effect in that same speed range (about 50 mph), which is why the players in the 2010 World Cup noticed the effect more frequently.

The smoother a ball is, the higher the speed at which the knuckling effect occurs. However, with the increased roughness of the Brazuca, this critical speed for maximum knuckling is reduced to about 30 mph. So it is expected that the 2014 World Cup ball will have a more predictable flight path

at typical striking speeds.

“The players should be happier with the new ball,” predicted Mehta. “It is more stable in flight and will handle more like a traditional 32-panel ball.”

Will this make the game less exciting? The answer is -- no. With a new understanding of the aerodynamics of the Brazuca football, the audience, especially kids, can better appreciate the feats of skill on the field. Elite athletes will continue to manipulate the ball in amazing ways. They don’t have the terms like “Bend it like Beckham” for nothing.

GOOOOOOAAAAAAL!



## Ames ongoing monthly events calendar

**African American Advisory Group (AAAG) Mtg.**, last Tuesday of each month, 12 - 1 p.m., Bldg. N-255, Rm. 101C. POC: Rose King, ext. 4-3442.

**Moffett Aikido Club**, Monday and Wednesday evenings, 6:30 p.m., Bldg. 944. Aikido is a non-competitive, defensive martial art known as the "Way of Harmony." POC: Diane Pereda (650) 575-9070 or Robert Dean (650) 787-1007, email: mfaikido@aol.com

**Ames Amateur Radio Club**, third Thursday of each month, noon, N-T28 (across from N-255). POC: George Tucker, at ext. 4-2200.

**Ames Bluegrass Club**, every Tuesday from 11:30 a.m. to 1 p.m. in Bldg. 944. Players of all instruments and all levels are welcome, but we are particularly interested in experienced players willing to help improve the group's musical skills. POC: Bob Haberle at ext. 4-5494 or email: robert.m.haberle@nasa.gov

**Ames Bocce Ball Club**, Ames' newest Exchange-sponsored club is seeking members. POC: Mike Lindsay email: michael.c.lindsay@nasa.gov

**Ames Bowling League**, at Fourth Street Bowl in San Jose. Looking for teams of four for start of season, Sept. 4. Need regular and substitute bowlers. Thursdays starting at 6:15 p.m. For sign up questions: Michael Hom at ext. 4-0302 or Mina Cappuccio at ext. 4-1313.

**Ames Contractor Council Mtg.**, first Wednesday of each month, 11 a.m., Bldg. N-200, Committee Room. POC: Herb Finger at ext. 4-6598.

**Ames Federal Employees Union (AFEU) Mtg.**, third Wednesday of each month, noon, Bldg. N-204, Rm. 101. Guests welcome. Check for schedule changes at: <http://www.afeu.org>. POC: Paul K. Davis, ext. 4-5916.

**Ames Golf Club**, Members have the opportunity to play approximately 13 tournaments per year at a variety of 18-hole golf courses in the Bay and Monterey Area. POC: Barry Sullivan: Barry.T.Sullivan@nasa.gov.

**Ames Green Team** (formerly the Green Ames Working Group) meetings are held the first Tuesday of each month in Bldg. N-237, Rm. 101, from 10 - 11 a.m. POC: Roger Ashbaugh, Ames Environmental Management Division, ext. 4-5660. Web: <http://environmentalmanagement.arc.nasa.gov/reports/eo-13514.html>

**The Hispanic Advisory Committee for Excellence (HACE) Mtg.**, first Thursday of each month, 11:30 a.m. - 12:30 p.m., Bldg. N-255, Rm. 101C. POC: Jeanette Zamora, jeanette.zamora-ortega-1@nasa.gov.

**Ames Jazz Band Club**, Bldg. 944, 5:30 p.m. - 7 p.m. POC: Ralph Bach, email: ralph.e.bach@nasa.gov

**Jetstream Toastmasters**, Mondays, 12 p.m. - 1 p.m., Bldg. N-269, Rm. 179. POC: Tim Steiger, ext. 4-0195, tim.steiger@nasa.gov. Web: <http://jetstream.freetoasthost.com>

**Ames Nimble Knitters Club**, every Monday at 11:30 a.m., Bldg. N-210, Rm. 141. POC: Diane Alexander at ext. 4-3140 or email diane.alexander-1@nasa.gov. All knitters and crocheters are welcome to attend and participate in our charity projects.

**Ames Roller Hockey Club**, meets daily from noon to 1 p.m. at rink on north end of the 80-foot-by-120-foot wind tunnel. Players should have experience skating and must wear protective equipment. POC: James Prunty, james.a.prunty@nasa.gov

**Ames Safety Committee**, third Thursday of each month, 10 a.m. - 11 a.m., Bldg. N-237, Rm. 200. POC: John Livacich, jlivacich@mail.arc.nasa.gov, ext. 4-3243.

**Women's Influence Network (WIN)**, first Wednesday of each month, Bldg. N-232, Rm. 227, noon - 1:00 p.m., POC: Wendy Holforty, wendy.l.holforty@nasa.gov

## Exchange Information

Information about products, services and opportunities provided to the employee and contractor community by the Ames Exchange Council. Visit our web site at: <http://exchange.arc.nasa.gov>

**Beyond Galileo Gift Shop N-235 in the cafeteria**, 8 a.m. - 2 p.m., ext. 4-6873

**Visitor Center Gift Shop (Exploration Center)**, Tues-Fri, 10 a.m. - 4 p.m., Sat. - Sun, 12 - 4 p.m., ext. 4-5412

Remember to purchase your baby shower, birthday and holiday gifts at Ames' two gift shops!

**Mega Bites Cafeteria N-235**, 6 a.m. - 2 p.m., ext. 4-5969/Catering ext. 4-2161

**Barcelona Café, Bldg. 3**, 6:30 a.m. - 2 p.m., ext. 4-4948/Catering ext. 4-4948

See daily menus at: <http://exchange.arc.nasa.gov/cafe/menu.html>

**Moffett Field Golf Club with 'Tee Minus One' Grill and Sports Bar**. Catering available. Call (650) 603-8026. Extended Happy Hour Thursdays, \$5 and \$6 pitchers of beer starting at 4 p.m. - 8:30 p.m.

**RV lots available**. Call to reserve a space at (650) 254-1808.

Civilian/Contractors, \$50/mo; military \$25/mo

**NASA Lodge (Bldg. 19)** (650) 603-7100  
Where to stay when you're too tired to drive home? What about the lodge?! Two types of rooms: Bldg. 19 (43 rooms), rate: \$65/night (\$5 ea add'l adult); Bldg. 583 A&B (150 rooms), rate: \$55/night (\$5 ea add'l adult); B547 rate \$60/night (for large groups)

**Ames Swim Center (N-109)** (650) 603-8025

The swimming pool is now open. Hours of operation are as follows (lap swim only):

MWF 10 a.m. - 1 p.m.

MWF 3 p.m. - 6 p.m.

TTH 10 a.m. - 1 p.m.

TTH 4 p.m. - 7 p.m.

The pool is heated year round. The pool normally is available for lap swim, pool parties and special events. POC: Ryan Storms, pool manager (650) 603-8025. Memberships: single memberships: \$60/yr. Family memberships: \$80/yr. After purchasing a membership, there is an entrance fee: daily entrance fee - \$3/day or lap pass fee - \$50 for 20 uses. Platinum membership - \$380/yr. (no daily fee). Special events include military training, swim team events, kayak role practice, etc. The cost for special events is \$75/hr, or \$50/hr for military.

**Exchange basketball gym is now open, Bldg. 2** (650) 603-9717

Hours of operation:

M-F 11 a.m. - 1:30 p.m.

M-F 4 p.m. - 7 p.m.

**Chase Park reservations**, call ext. 4-4948  
**NACA Park reservations**, call ext. 4-4948

## Ames Cat Network

The Ames Cat Network needs help finding homes for cats trapped at Moffett. They range from feral to abandoned/lost pets. They are tested, altered and inoculated. Call Iris at ext. 4-5824 if you or someone you know are interested in fostering or adopting a cat.

## Ames emergency announcements

To hear the centerwide status recording, call (650) 604-9999 for information announcements and emergency instructions for Ames employees. You also may listen to 1700 KHz AM radio for the same information.

## 75th T-shirts and coins given



NASA photos by Jon Pierre Wiens

The NASA Ames 75th anniversary T-shirts and coins arrived recently and were given, one each, to Ames employees along with a commemorative coin, compliments of the Ames Exchange. They were distributed alphabetically over the duration of a week. Employees above are seen waiting in line to pick up their T-shirt and coin.

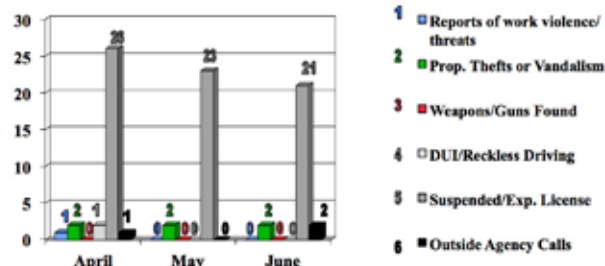


Shizuko Shanda, left, checking names and handing out a T-shirt and coin to Mike Wilder.

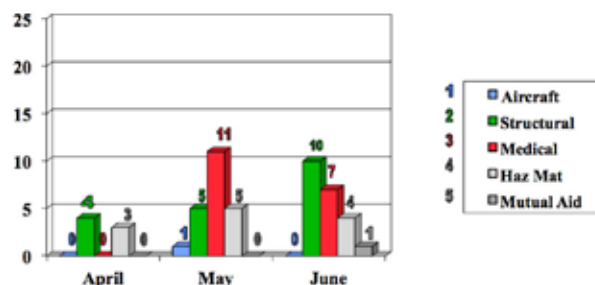
## Protective Services monthly activity

A statistical summary of activities of the Protective Service Division's Security/Law Enforcement and Fire Protection Services units for the three-month period ending June 2014 is shown below.

### Protective Services Office – Activities Security/Law Enforcement Monthly Activity Report



### Protective Services Office – Activities Fire Protection Services



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